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Los Alamos
NATIONAL LABORATORY
EST. 1943

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ABSTRACT
Satellite Reconnaissance: From CORONA to Commercial

This presentation provides an overview of the history of US satellite-based reconnaissance as has been publicly revealed (through Declassification by the NRO) by the US Government to date. From there, it transitions to the evolutionary and revolutionary role that commercial satellite imagery is now playing on the international stage in providing a heretofore-unimaginable basis for greater global transparency and the way it has helped, and will continue to help, to detect and monitor undeclared unconventional weapons related facilities and activities. In addition, new geospatial tools, which draw heavily upon commercial satellite imagery as well as augmenting it, have also become available over the Internet. Among those Geospatial tools, "Digital Virtual Globes" (i.e., Google Earth, Virtual Earth, etc.) not only provide a much improved mapping capability over previously used simple plan-view line drawings used by various international inspection organizations such as the International Atomic Energy Agency (IAEA), but they offer much improved visualization of known and inspected sites for:

1) Site familiarization and inspector training
2) Pre-inspection planning
3) Onsite orientation and navigation
4) Post-inspection reporting
5) Site monitoring over time for changes
6) Verification of states' site declarations and for input to State Evaluation reports
7) A common basis for discussions with member states

Such digital globes also promote global transparency by providing a new, essentially free, means to conduct broad area baseline search via tip-off through open source leads; identified on internet Blogs and Wiki layers with input from a "free" cadre of global browsers and/or by knowledgeable local citizens that can include ground photos and maps; or by other initiatives based on existing country program knowledge. The digital globes also provide highly accurate terrain mapping for better overall geospatial context and allow detailed 3-D perspectives of all sites or areas of interest. 3-D modeling software (i.e., Google's SketchUp6) when used in conjunction with these digital globes can significantly enhance individual building characterization and visualization (including interiors). These new geospatial tools also now make it possible for anyone to conduct his or her own satellite-based reconnaissance for any application from the comfort of home, at a WI-FI enabled coffee shop, or even on the beach at a tropical island resort...and a lot of it can be done with just a smart phone.

Technology and National Security
MS&E 193

LA-UR# 11-XXXXX
28 NOV 2011

Satellite Reconnaissance: From CORONA to Commercial

Frank Pabian
International and Applied Technologies (IAT-1)
Global Security Directorate

Not to Be Confused With...

Aerial Reconnaissance: From Balloons to Blackbirds

The Union balloon corps. During the winter of 1861–1862, Lowe gathered around himself an aeronautic crew that included two other ballooning pioneers, brothers Ezra and James Allen

*Source: https://www.cia.gov/library/center -for-the-study-of-intelligence/csi-publications/books -and-monographs/the -cia-and-the-u-2-program-1954-1974/u2.pdf

Project GENETRIX. By far, the most significant use of balloon reconnaissance during the Cold War was Project GENETRIX. The program had its origins in a 1951 study by the RAND corporation, and in December 1955, President Dwight D. Eisenhower gave approval for the U.S. Air Force to launch 516 camera-carrying balloons over Eastern Europe, the Soviet Union, and the People's Republic of China.*

Successor to the Lockheed U-2, the Lockheed SR-71 is an advanced, long-range, Mach 3 strategic reconnaissance aircraft developed from the Lockheed A-12 and YF-12A aircraft by the Lockheed Skunk Works as a Black project. The SR-71 was unofficially named the Blackbird

"Spy Satellites" Have Long Remained Under a Cloak of Secrecy...However:

President Jimmy Carter acknowledged publicly for the first time that the United States operates photoreconnaissance satellites

President Bill Clinton signed Executive Order 12951 that declassified every frame of imagery acquired from the CORONA (KH-1 through -4), ARGON (KH-5), and LANYARD (KH-6) systems. Furthermore, the President delegated any future declassification approval to the Director of Central Intelligence upon concurrence by the Secretaries of Defense and State.

Clinton's order was opposed by many within the intelligence community, including the leadership of the NRO. The organization had operated for so long in the black that shedding even the slightest amount of light on its activities produced howls from many of its officials. But the declassification of CORONA, including an academic conference that discussed its origins and achievements, brought the NRO and the intelligence community something that they rarely get, praise. *Dwayne A. Day, Monday, November 8, 2004*

CIA Director George Tenet's decided to declassify nearly all of the images acquired by the "GAMBIT-1" (KH-7) and "HEXAGON" (KH-9) imagery systems

NRO declassifies the "GAMBIT-3" (KH-8) imagery system (but not the imagery)

Sources: and

CORONA (KH-1 through -4), ARGON (KH-5), and LANYARD (KH-6) systems

Camera, Film, and Image Parameters

System	KH-1, KH-2, KH-3, KH-4	KH-4A	KH-4B	KH-5	KH-6
Camera Type	Panoramic	Panoramic	Panoramic	Frame	Panoramic
Film Width	70 mm	70 mm	70 mm	5 in	5 in
Focal Length (in.)	24	24	24	3	66
Best Ground Resolution (approx.)	25 ft.	9 ft.	6 ft.	460 ft.	6 ft.
Nominal Orbit Altitude (km)	165-460	185	150	322	172
Nominal Photo Scale on Film	1:275,000 to 1:760,000	1:305,000	1:247,500	1:4,250,000	1:100,000
Nominal Ground Coverage/Image Frame (km)	15 x 210 to 42 x 580	17 x 232	14 x 188	483 x 483	12 x 64

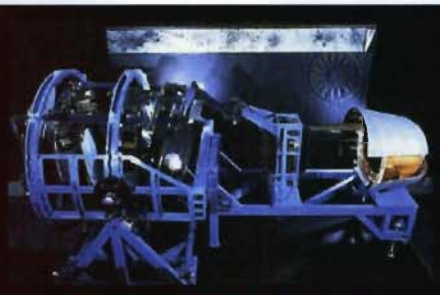
Of the 144 total Corona missions, 102 were successful. Of the 11 Argon missions, 6 were successful. Of the 3 Lanyard missions, 1 was successful.

Source: http://space.jpl.nasa.gov/msl/Programs/corona.html

Military Space

Smithsonian National Air and Space Museum

Model, Corona, Bucket and Stand



Camera, KH- 4B, Corona

First Titan-3D launch with KH-9A

Part of a once-secret program known as Project Corona, cameras of this type were used by the United States to photograph intelligence targets on Earth from space. Between August 1960 and May 1972, when the program ended, more than 800,000 images were returned by Corona satellites. Film return capsules--or "buckets"--were ejected by the spacecraft in orbit, reentered the atmosphere, and were retrieved in midair. During the Cold War, Corona photographs eased fears that the Soviet Union might be preparing a nuclear surprise attack.

With the Soviet launch of Sputnik in 1957, the United States recognized that the need for timely information on enemy forces had become urgent. Until the shooting down of an American U-2 "spy plane" in May 1960, such intelligence had been provided by high-flying balloons and aircraft. Under the cover of a scientific research program known as Discoverer, Project Corona--a joint effort by the U.S. Air Force and America's Central Intelligence Agency--began returning photographs of the Soviet Union taken from space just three months after the U-2 was shot down. Corona was supplanted in May 1972 by more advanced photoreconnaissance satellites, which remain classified.

The first success of the Corona program occurred on August 18, 1960, when Discoverer-14 returned film of the Soviet Union taken from space. The Corona KH-series cameras were launched by Atlas-Agena rockets from Vanderberg AFB in California. The film-return capsules were recovered in midair by aircraft of the USAF's 6594th Test Group over the ocean near Hawaii. Between this first success and the last satellite in the program--#1117, launched on May 25, 1972--there were a total of 145 Corona missions, returning nearly a million images of "denied" territory. During the life of the program, resolution improved from 8 meters (25 feet) to approximately 2 meters (6 feet). The KH-4B is a stereoscopic version of the Corona camera, with twin film retrieval capsules, and was used in the late 1960s.

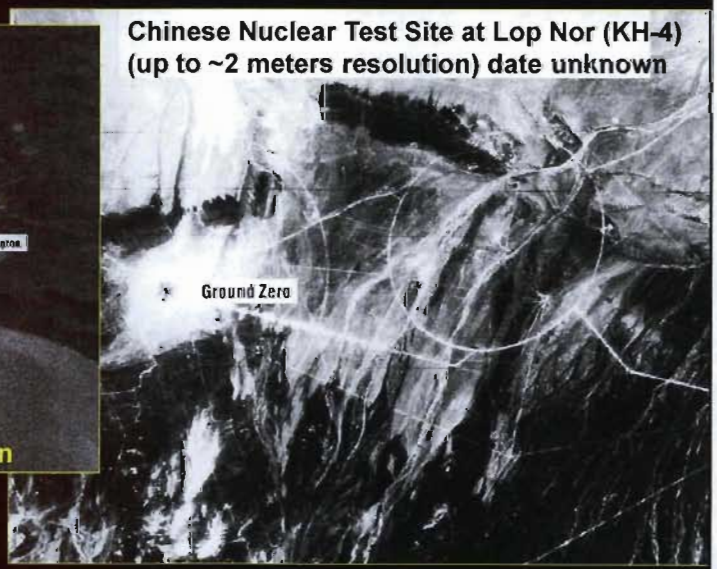
Corona was the world's first "spy satellite." From the outset, its images played a major role in the Cold War by dispelling fears in the United States of a widening "missile gap" with the Soviet Union. As resolution improved, Corona's images were used for strategic targeting as well as for the verification of arms control treaties between the United States and the Soviet Union.

CORONA on the Cold War Front Line

12 meter resolution

First CORONA (KH-1) Image of Soviet Airfield at Mys Shmidta 18 August 1960

Chinese Nuclear Test Site at Lop Nor (KH-4) (up to ~2 meters resolution) date unknown



Source: http://www.nro.gov/corona/cor-ab.html

Highlights of CORONA (KH-4) Program

- August 1960: First successful flight
- Provided US unimpeded access to "denied areas" (i.e., Soviet Union, China, DPRK, etc.)
- Six variants developed, each with improved capabilities from 12 meters to 1.5 meter resolution (KH-1, KH-2, KH-3, KH-4, KH-4a, KH-4b)
- Provided objective corroboration of other source information and helped to confirm or dispel existing perceptions of adversaries' physical strengths and weaknesses (i.e. missile gap)
- Provided broad area search and mapping coverage essential for detecting and monitoring military and economic (industrial and agricultural) developments in those areas
- 1972: Program Ended (supplanted by the KH-9 system)
- February 1995: Vice President Al Gore unveiled First CORONA satellite photographs to public at CIA HQ's

Source: http://www.nro.gov/foia/docs/foia-corona-story.pdf

Satellite Imagery: From Corona (KH-4) to Commercial Comparison

US "Spy" Photo (Declassified in 1995)

Corona Photo, 25 September 1967
Source: http://www.nro.gov/corona/cor-ab.html
http://en.wikipedia.org/wiki/File:Corona_pentagon.jpg

Google Earth Image

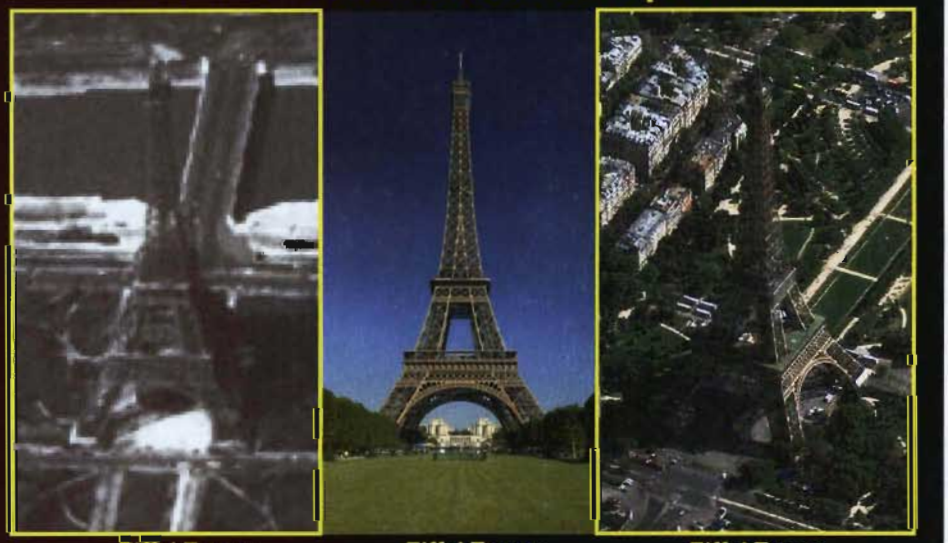
Google Earth 25 October 2007
(Digital Globe)

Highlights of the KH-7 Surveillance System

- Operational from July 1963 to June 1967
- Flew 38 missions; duration of missions spanned one to eight days
- Returned single bucket of film to earth for each mission
- Returned 19,000 frames, totaling 43,000 linear ft "Footprint" on the ground was approximately 10 nm by 12 nm; total ground coverage for all missions was about 6.6 million sq nm
- Intelligence Community's first high-resolution surveillance or "spotting" imaging satellite
- Best resolution was initially four ft (~1.2 meters) on ground; by 1966, best resolution reportedly improved to two ft (~.6 meters)
- Capable of imaging areas 12 nm wide, ranging from 5-400 nm long
- Provided key cartographic information for large scale (1:50,000) maps for Department of Defense
- Declassified in 2002

Source: http://www.globalsecurity.org/intell/library/news/2002/kh-7_kh-9_factoids.htm

KH-7 to Commercial Comparison



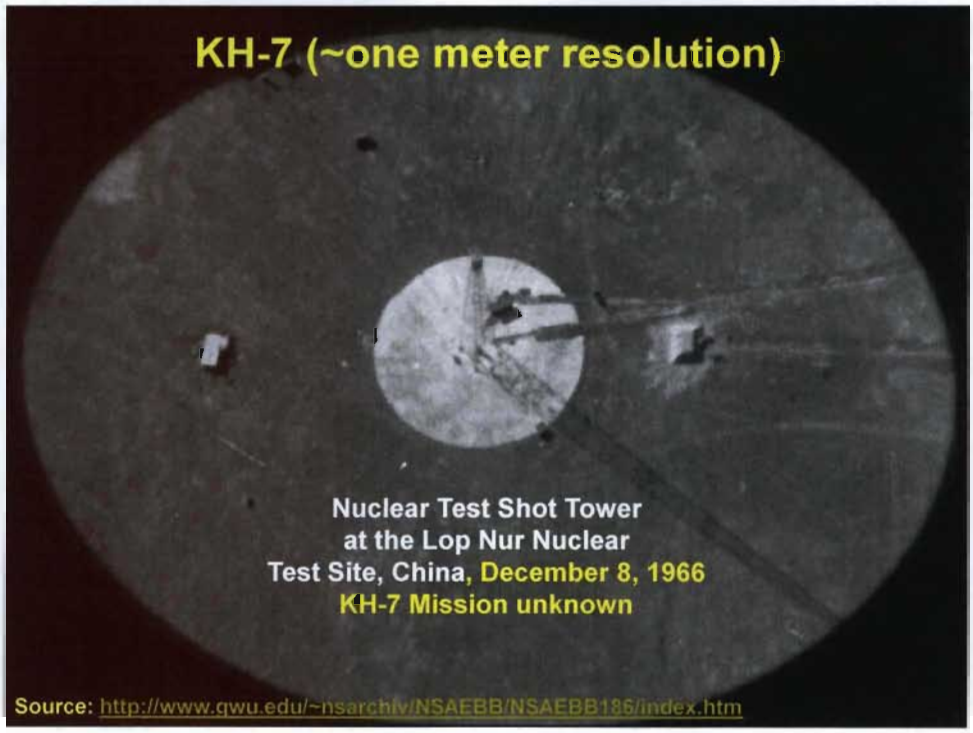
Eiffel Tower
20 Mar 1966
KH-7 Mission 4026
(Declassified in 2002)

Eiffel Tower
Ground photo

Eiffel Tower
[illegible]
Digital Globe

Source: http://www.usgs.gov/features/satellite_images.html

KH-7 (~one meter resolution)



Nuclear Test Shot Tower
at the Lop Nur Nuclear
Test Site, China, December 8, 1966
KH-7 Mission unknown

Source: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB186/index.htm

Highlights of the KH-8 Surveillance System "Eye of the Eagle"

Gambit 3, with its efficient target acquisition and high image resolution, enhanced surveillance capabilities from July 1966 – April 1984.

PROGRAM FACTS
Missions: 54 (50 successes)
Average Mission Life: 31 days
Imaging Days: 5-126 days
Altitude: 65-90 nautical miles
Roll Control: mechanical roll joint
Payload Weight: 4,130 lbs
Image Retrieval: Film Return Capsule

OPTICS/IMAGING
Aperture: 43.5 inches
Focal Length: 175 inches
Camera Developer: Eastman Kodak
Lens: f/4.09
Image Resolution: better than 2 feet
Film Length: up to 12, 241 ft
Film Width: 5 inches and 9 inches

- Declassified in 2011
- Resolution <2 Feet
- NO IMAGERY YET RELEASED

http://www.nro.gov/foia/declass/GAMHEX/Videos/1.mov

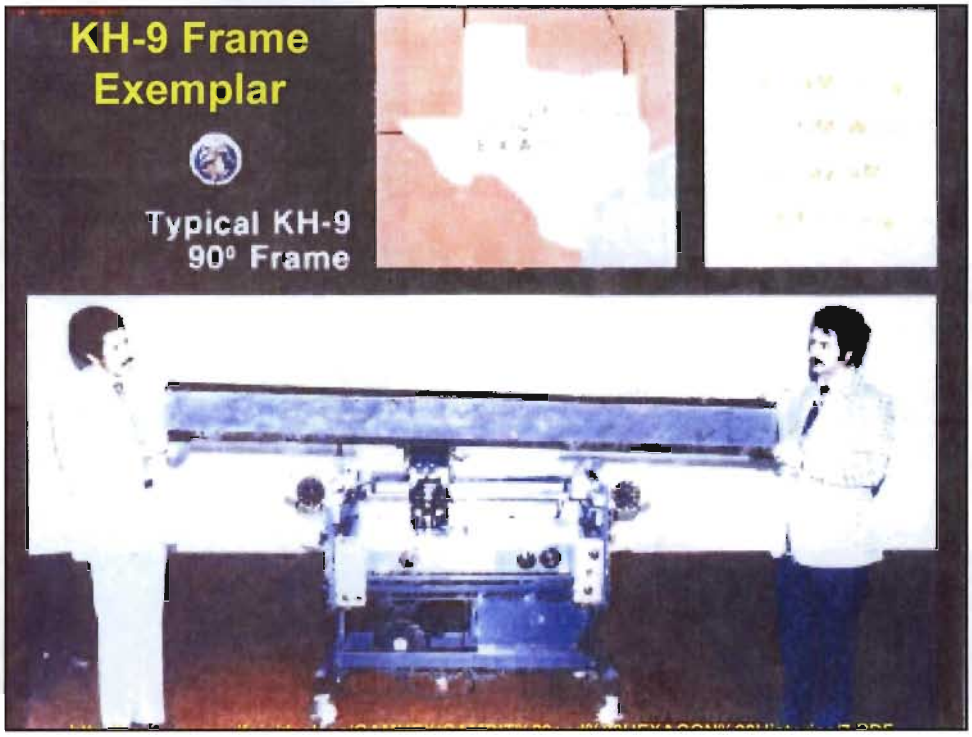
http://www.nro.gov/history/csnr/gambhex/GAM_3_Fact_sheet.pdf

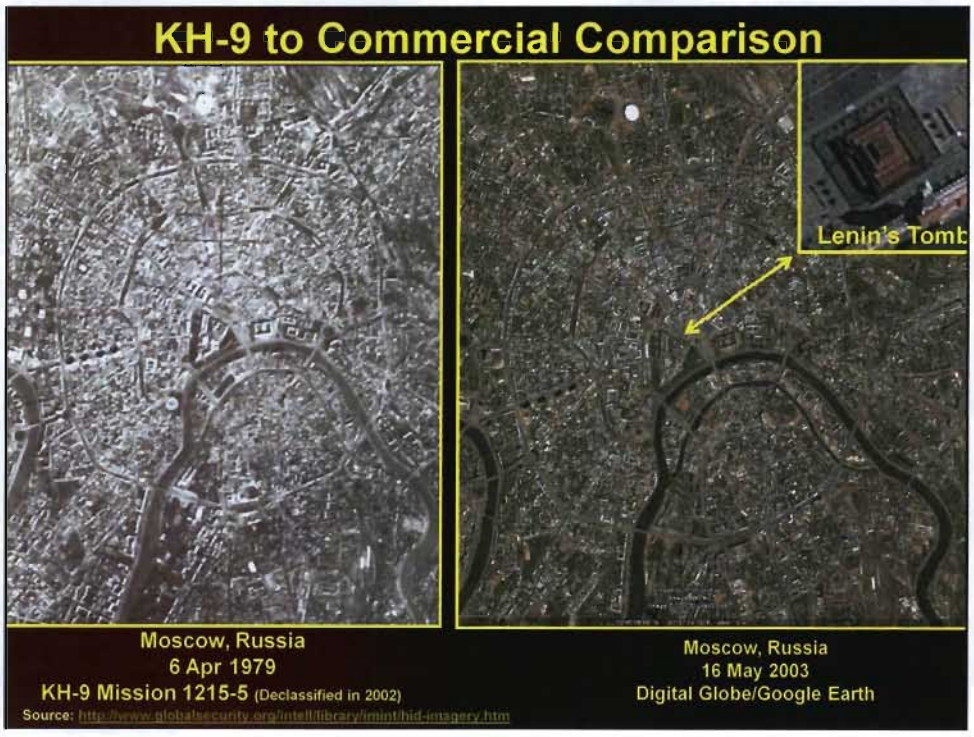
Highlights of the KH-9 Mapping System

- Operational from March 1973 to October 1980
- Flew 12 missions (all successful); duration of missions spanned 42 to 119 days "Frame camera" imagery system; devoted solely to mapping, charting, and geodesy (MC&G)
- Returned single bucket of film to earth for each mission
- Returned 29,000 frames, totaling 48,000 linear ft
- "Footprint" on the ground was approximately 70 nm by 140 nm; total ground coverage for all 12 missions was about 104 million sq nm
- Provided key cartographic information for Level 1 Digital Terrain Elevation Data (DTED) and 1:200,000 scale maps
- Coverage of key control point areas was imaged in stereo or trilaps (three times) on a single operation to provide analysts with enough detailed information
- Average resolution initially ~10 meters on ground; reportedly improved to ~6 Meters on later missions
- Declassified in 2002

Sources: http://www.archives.gov/press/press-releases/2003/nr03-02.html and http://www.nro.gov/foia/declass/GAMHEX/GAMBIT%20and%20HEXAGON%20Histories/7.PDF

Highlights of the KH-9 Mapping System "Sentinel of Liberty"


KH-9 Frame Exemplar
Typical KH-9 90° Frame


KH-9 to Commercial Comparison
Lenin's Tomb
Moscow, Russia
6 Apr 1979
KH-9 Mission 1215-5 (Declassified in 2002)
Source: http://www.globalsecurity.org/intell/library/imint/hid-imagery.htm
Moscow, Russia
16 May 2003
Digital Globe/Google Earth

KH-10 (Planned, but Never Operational)

PBS Documentary Video Clip on Military Astronauts as Space-Based Imagery Collectors: "Astrospies"

http://www.pbs.org/wgbh/nova/preview/g_3503_300.html

PBS Interactive Map Showing Historical Applications Of Space Based Reconnaissance

http://www.pbs.org/wgbh/nova/astrospies/phot-flash.html

http://www.afspacemuseum.org/displays/GeminiCapsule/index.htm

Evolution of Commercial Satellite Imaging Industry

1960	• USG Launch of 1st spy satellite	*~12 m and less*
1972	• USG Landsat satellite	90m
1984	• USG Landsat satellite	30m
1986	• French SPOT satellite	10m
1988	• Russian satellite	7m
1995	• Indian satellite	5m
1992	• *Congress passes Landsat Act*	-
1994	• *Presidential Executive Order*	-
1999	• USG Landsat 7	15m
1999	• US commercial IKONOS	.82m
2000	• Israeli EROS satellite	1.0m
2001	• US commercial QuickBird	.61m
2002	• *CIA Memo to use commercial imagery*	-
2003	• *Presidential Policy on Commercial Remote* Sensing	-
2004	• US commercial Orbview-3	1.0m
2007	• US commercial WorldView-1	.5m
2008	• GeoEye-1	.41m or 16in.
2009	• *DNI/SECDEF Imagery Way Ahead*	-
2013	• GeoEye-2	.25m or 9.75 in

GeoEye

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DNI Dennis Blair and Bruce Carlson, Dir. NRO GEOINT Symposium, Oct. 21, 2009

- "So as part of our architecture , it's not just building that system, but it's also continuing and in fact increasing our strong reliance on commercial providers of imagery – commercial imagery . . . . But we're basically committed to a foundational imagery architecture that is balanced, that incorporates both government systems and commercial systems, and we think it will serve this country well for many years. . ." (Director of National Intelligence , Dennis Blair, Oct. 21, 2009, GEOINT Conference)

- "We work hand in hand with the NGA and we're a great fan of putting commercial imagery into the system. Our national systems are oversubscribed everyday, and some of our military and intelligence community's needs don't demand the kind of precision that we can put on an image . . . . Our goal is to fully integrate commercial imagery with our systems so that we can quickly disseminate imagery whenever it's needed." (Director of the NRO, Bruce Carlson, as quoted in the *Space News* Q&A Profile, Oct. 19, 2009)

Courtesy: GeoEye

NGA & DNI Public Comments on Commercial Imagery

October 1, 2008

- "We are the single strongest supporter of the **commercial remote sensing** industry. It is absolutely integral to our success and is a fundamental building block for what we do as an agency" (NGA Director, VADM Murrett)

Dec. 21, 2009

- An integral part of NGA's mission is **commercial satellite imagery**, which allows the US to share images with our allies around the globe because the images are unclassified. There will continue to be tremendous demand for **commercial imagery** in the future." (Ken Peterman, NGA program manager)

OCT. 17, 2011

- "*Well, I think we are committed – in fact there's a national security presidential directive to that effect to sustain – from the standpoint of a healthy industrial base – to support **commercial imagery. Commercial imagery** – and I'm a big believer in it; I certainly was when I was director of NGA – has a very important complementary role to play. And of course, **it has great utility because it's a fact it's unclassified**. So it's invaluable in sharing in overseas coalition endeavors, which we do constantly, and it's certainly huge in disaster recovery and those sorts of things. So we will continue to support **commercial imagery**. (James Clapper, DNI)*

Courtesy: GeoEye

Satellite Imagery for All:
A New Era of Global Transparency!

*"Perhaps this is also a good moment to step back in awe at what modern technology has wrought the ability for any sufficiently concerned citizen or organization to scrutinize any desired spot on Earth within hours of making the request, and then being able to publish the result to a context-rich virtual globe that is universally available. That's a profound shift in favor of accountability, transparency and democracy. **Monitoring the planet has been crowdsourced**."*
Stefan Geens of Ogle Earth

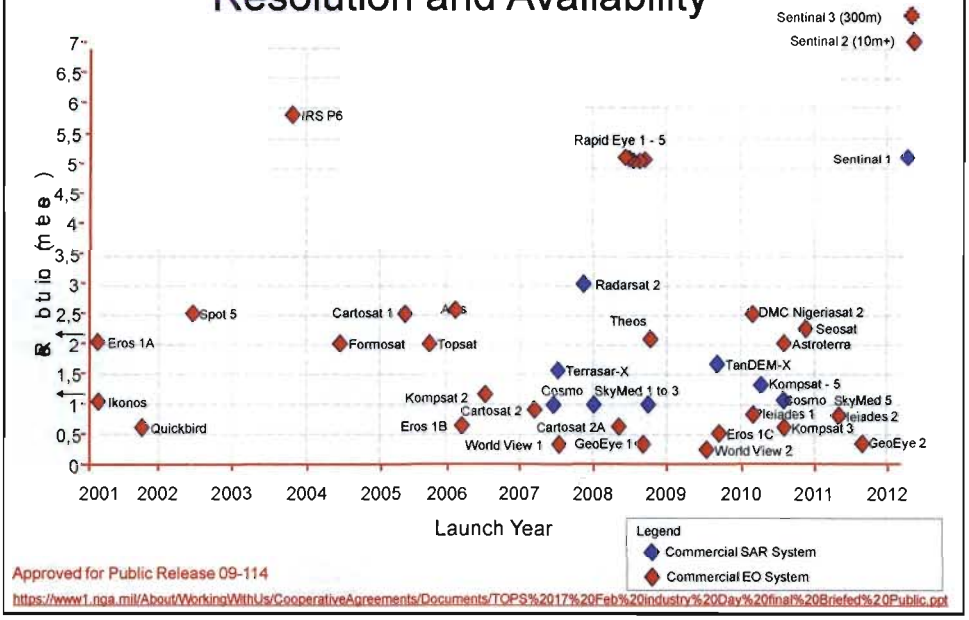
"Clearly it has an effect on the way diplomacy will be carried out in the future".
Einar Bjorgo (UNOSAT).

Applications Include:

- **Emergency Response**
- **Disaster Management /Humanitarian Assistance**
- **Risk Prevention**
- **Peace-keeping**
- **Environmental Monitoring & Rehabilitation**
- **Post Conflict Reconstruction**
- **Social and Economic/Resource Development**
- **Treaty Verification and Monitoring**

Sources: http://www.ogleearth.com/2009/09/qum_nuclear_sit.html#comments
http://www.unspecial.org/UNS621/UNS_621_T32.html

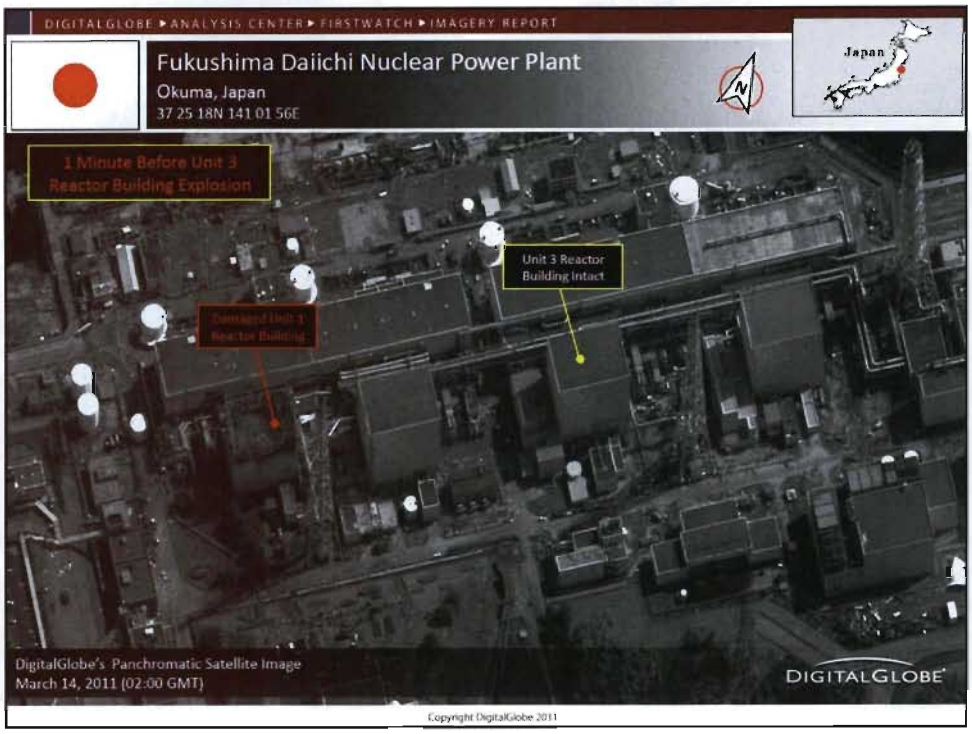
Satellite Sensors:
Resolution and Availability

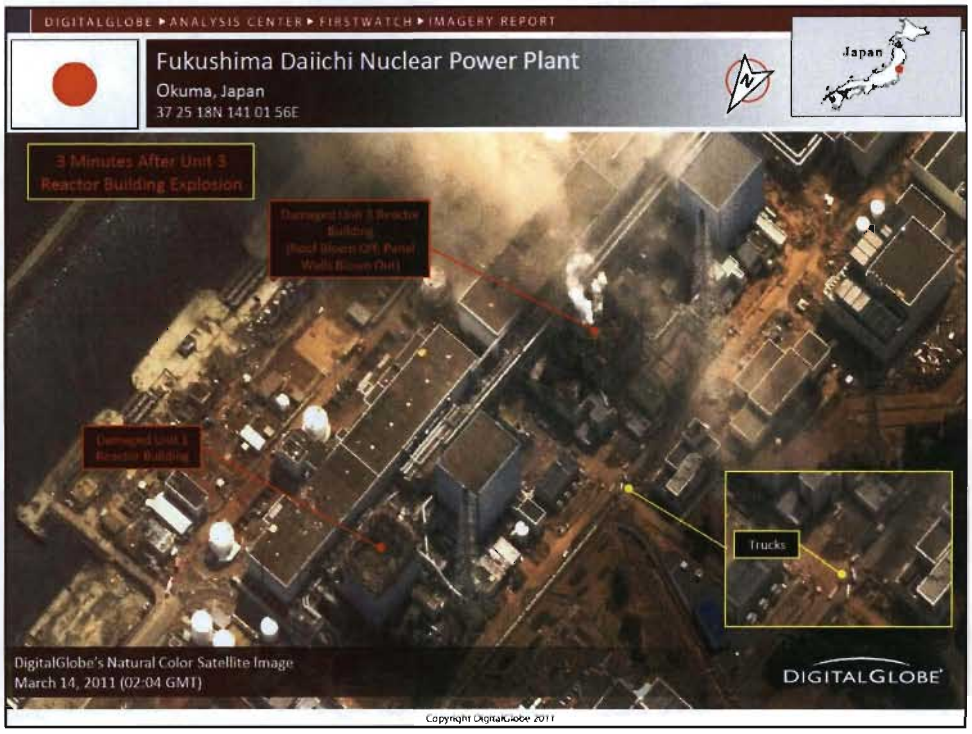


Approved for Public Release 09-114
https://www1.nga.mil/About/WorkingWithUs/CooperativeAgreements/Documents/TOPS%2017%20Feb%20industry%20Day%20final%20Briefed%20Public.ppt


First CORONA Compared with Google Earth
Russian (former Soviet) Airfield at Mys Shmidta
Runway
Parking Apron
12 meter resolution
First CORONA
(KH-1) 18 August
1960
Twin engine
cargo plane
Fixed wing single engine light
aircraft
Parking Apron
Digital Globe
Quickbird image
7 July 2004
Helicopter (rotors present)
With KH-1, one could barely discriminate the parking apron from the airfield, but with Google Earth, one can discriminate between airplanes and helicopters
Google


This was the Future - Then
U.S. Govt. Corona Spy Satellite
Runway
Parking Apron
Mys Shmidta Air Field, Soviet Union
Collected August 18, 1960
This Is the Future - Now
GeoEye-1 Commercial Satellite
Today's BEST!
Fixed wing single
engine light aircraft (Probable AN-2 "Colt"s)
4 rotor blades on the apron
Parking Apron
Helicopter (Probable Mi-4 "Hound")
(w/ rotor blades removed)
Mys Shmidta Airport, Chukotka, Russia
Mys Shmidta Air Field, Soviet Union
Collected July 7, 2009
GeoEye
24


DIGITALGLOBE ▸ ANALYSIS CENTER ▸ FIRSTWATCH ▸ IMAGERY REPORT
Fukushima Daiichi Nuclear Power Plant
Okuma, Japan
37 25 18N 141 01 56E
Japan
1 Minute Before Unit 3 Reactor Building Explosion
Unit 3 Reactor Building Intact
DigitalGlobe's Panchromatic Satellite Image
March 14, 2011 (02:00 GMT)
DIGITALGLOBE
Copyright DigitalGlobe 2011


DIGITALGLOBE ▸ ANALYSIS CENTER ▸ FIRSTWATCH ▸ IMAGERY REPORT
Fukushima Daiichi Nuclear Power Plant
Okuma, Japan
37 25 18N 141 01 56E
Japan
3 Minutes After Unit 3 Reactor Building Explosion
Trucks
DigitalGlobe's Natural Color Satellite Image
March 14, 2011 (02:04 GMT)
DIGITALGLOBE
Copyright DigitalGlobe 2011

Open-Source GEOINT: What do we mean?

NASA's Worldwind Mid-2004 | *GoogleEarth Mid-2005* | *Microsoft's Bing Maps (Virtual Earth) late-2005* (3-D feature halted late-2010) | *Skyline Globe 2006* (includes India Bhuvan and IGN Géoportail (France)) | *Nokia Maps 3D 2011* maps.yahoo.com

"Basir"? 2011 (Iran)

- **"Virtual Globes"** See: http://en.wikipedia.org/wiki/Virtual_globe
  Provide the means to virtual fly to any place on earth and gather information in a 3-D geospatial context and provide a platform for additional overlays
- **BLOGs and WIKIs** can provide critical tip-off, background, & locational info
- **Social Networks** (Panoramio, Flickr, & Twitter for "geotagged" ground imagery)
- **Geospatial Meta-search Engines/Viewers**
  - "GeoHack" (http://toolserver.org/~geohack/)
  - "GAIAGI" (http://www.gaiagi.com/)
- **Commercial Satellite Imagery**
- **Media, Academia, & NGOs** (locational information, ground photos, graphics, etc.)

You can access much of it on a Smart Phone!

Additional Data & Tools

Google Earth also offers :

- Historical imagery

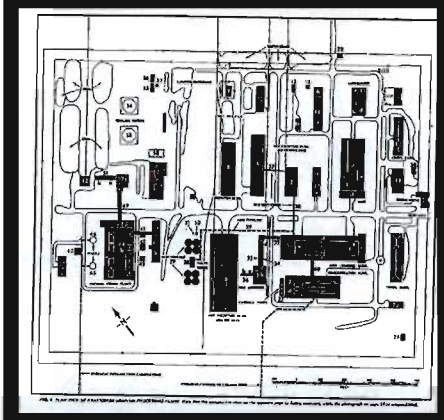
- Sunlight shadowing effects

- Real time weather (with real time clouds)

- Blogger labeling

- Measurements and distances from the imagery

US Intelligence Imagery Analysis of Nuclear Facilities Cold War Style



Line Drawing and Artist's 3-D Perspective View of Pyatigorsk Uranium Processing Plant in the Former Soviet Union (Pre-CORONA, circa 1959)

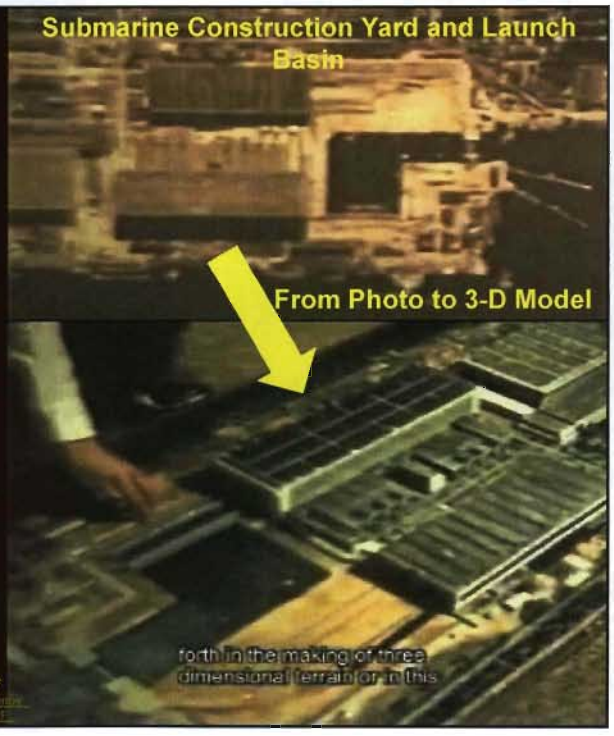
Source: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB186/doc01.pdf

"Exceptionally" high resolution Gambit photos acquired in stereo made it possible to build 3-D scale models to aid in the analysis of key sites

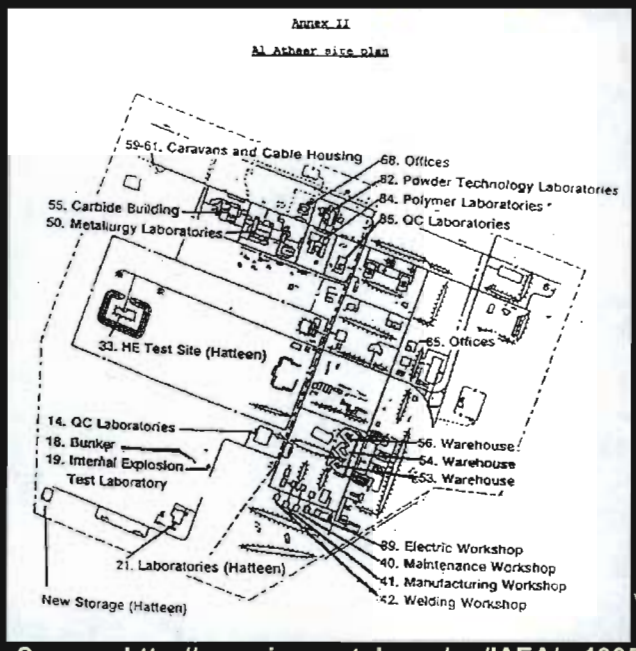
"STEREO PAIRS AVAILABLE IN ALL ROLL POSITIONS UP TO MAXIMUM ROLL CAPACITY OF 44.45°"

Photoanalyst using Stereo-microscope

Sources: http://www.nro.gov/foia/declass/GAMHEX/Videos/1.mov
And http://www.nro.gov/foia/declass/GAMHEX/GAMBIT/17.PDF



The best that the IAEA previously had for site visualization (circa mid-1990s)



Typical plan-view line drawing used during IAEA site inspections in Iraq

NOTE: U-2 and helicopter imagery were also used in Iraq, but that was an exception not currently applicable to IAEA Safeguards

Source: http://www.iraqwatch.org/un/IAEA/s-1995-1003-a.jpg

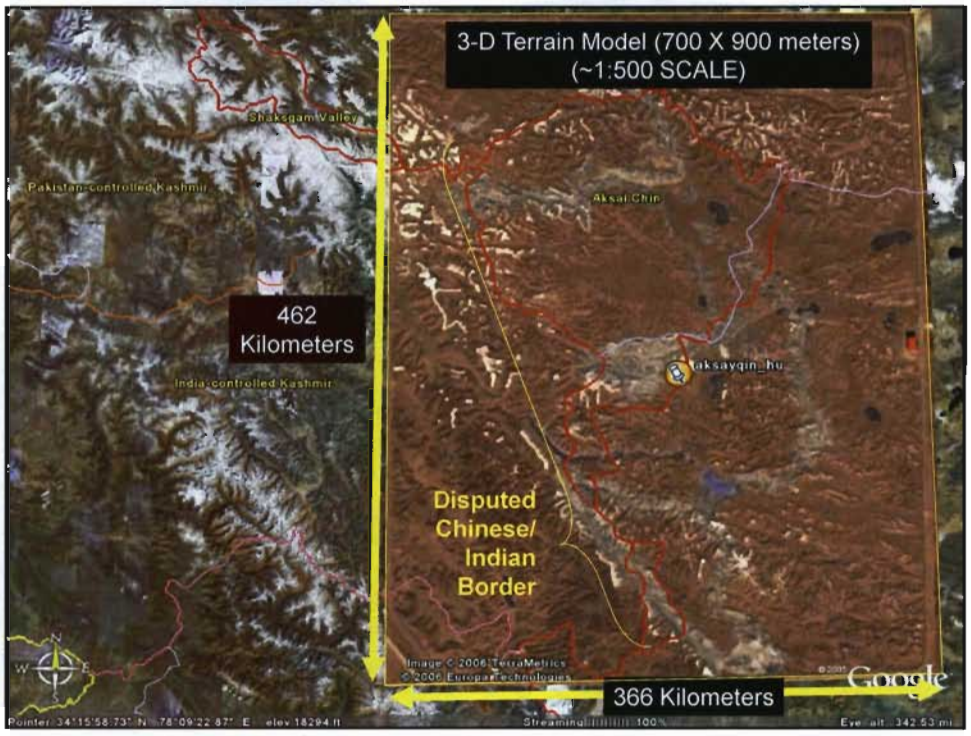
3-D Perspectives Today

Model of Iran's Uranium Enrichment Complex at Natanz

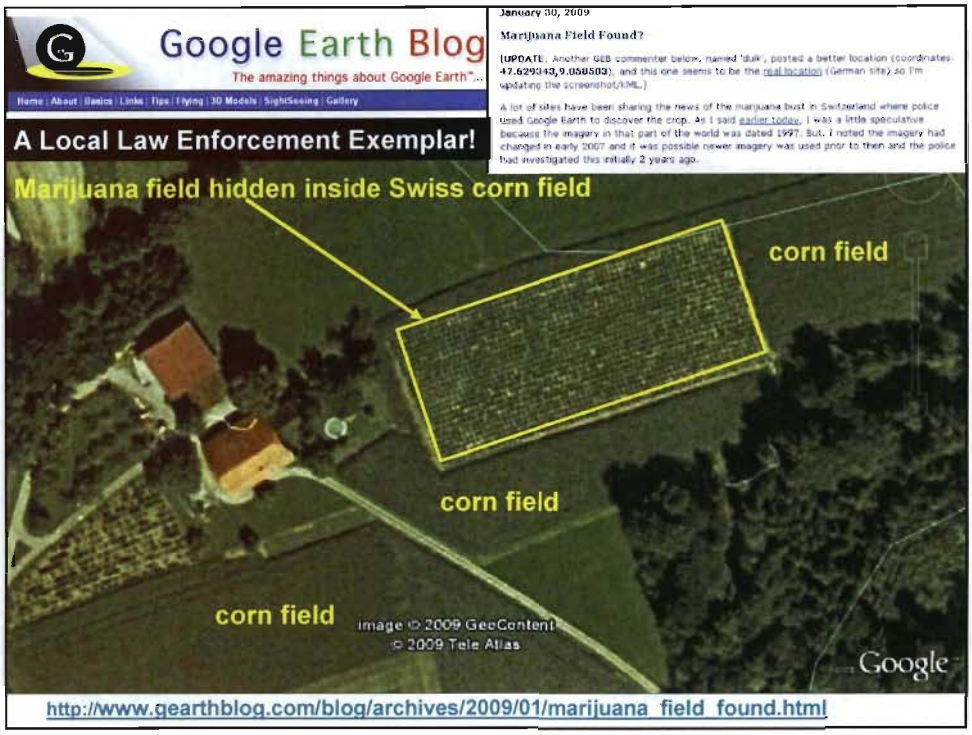
Created using Google's free SketchUp software with building textures derived from Internet searches of ground imagery


GoogleEarth as a Broad Area Search Tool:
User Uncovers Probable Mountain Warfare Terrain Model of Disputed China/India Border Area in Huangyangtan, China
Probable Military Training Center
A Clandestine Site Discovered by One of the Worldwide Cadre of Searchers That Can be Tapped for Free
3-D Terrain Model (700 X 900 meters) (~1:500 Scale)
Image © 2006 DigitalGlobe
Google

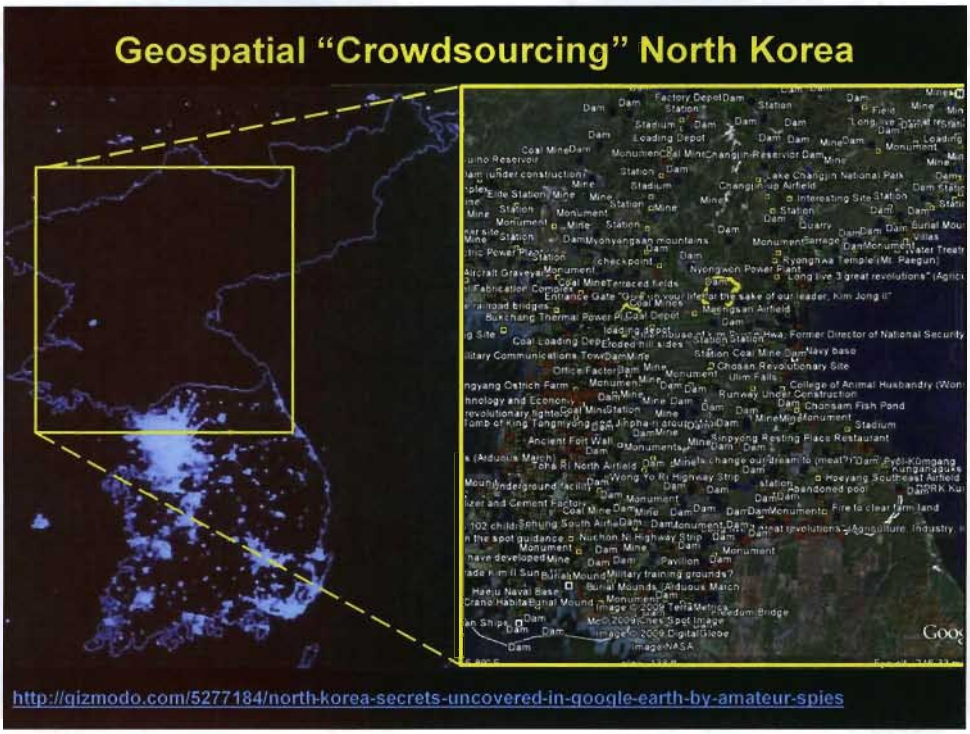

Location of Huangyangtan Terrain Model
Area of Disputed border replicated by Terrain model
Terrain Model Exemplar
XINHUA
© 2006 Europa Technologies
Image © 2006 NASA
Image © 2006 TerraMetrics
Google

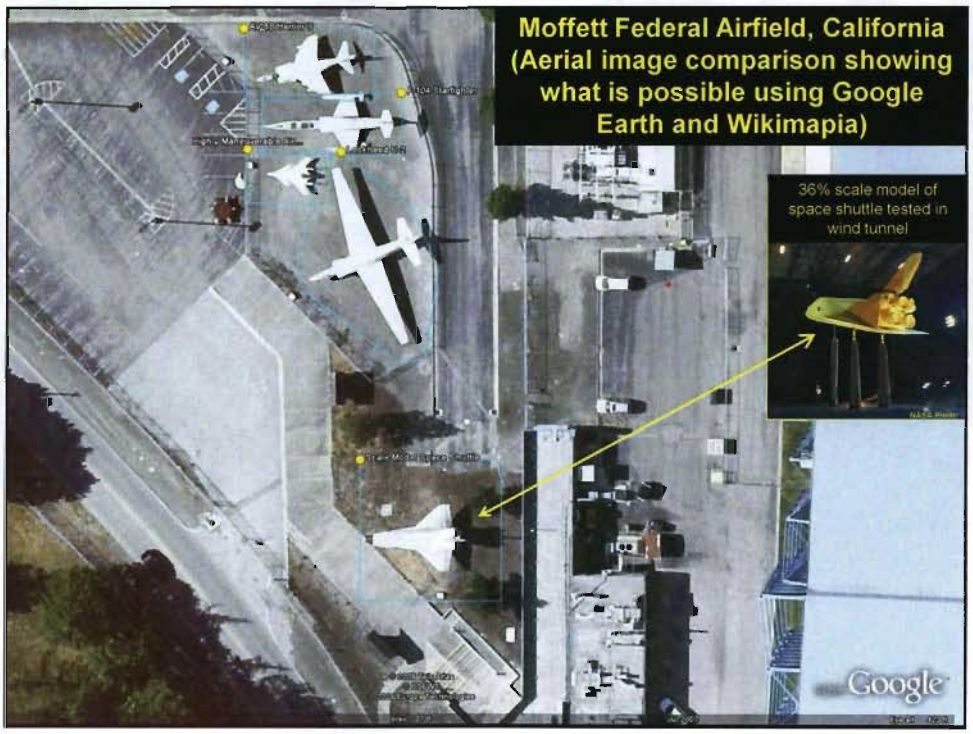

3-D Terrain Model (700 X 900 meters)
(~1:500 SCALE)
Shaksgam Valley
Pakistan-controlled Kashmir
Aksai Chin
462
Kilometers
India-controlled Kashmir
Taksayqin_hu
Disputed
Chinese/
Indian
Border
366 Kilometers
Google


"SS-25 TELs and open single-bay garages,
likely for START treaty verification purposes."
Amazing find by a Google Earth observer and reported in his BLOG
Source: http://geimint.blogspot.com/2009/03/site-news.html
Google
More "Crowd-Sourcing" or using "People as Ubiquitous Sensors"


Google Earth Blog
The amazing things about Google Earth™...
Home | About | Basics | Links | Tips | Flying | 3D Models | SightSeeing | Gallery
A Local Law Enforcement Exemplar!
January 30, 2009
Marijuana Field Found?
(UPDATE: Another GEB commenter below, named 'duk', posted a better location (coordinates: 47.629343,9.058503), and this one seems to be the real location (German site) so I'm updating the screenshot/KML.)
A lot of sites have been sharing the news of the marijuana bust in Switzerland where police used Google Earth to discover the crop. As I said earlier today, I was a little speculative because the imagery in that part of the world was dated 1997. But, I noted the imagery had changed in early 2007 and it was possible newer imagery was used prior to then and the police had investigated this initially 2 years ago.
Marijuana field hidden inside Swiss corn field
corn field
corn field
corn field
Image © 2009 GeoContent
© 2009 Tele Atlas
Google
http://www.gearthblog.com/blog/archives/2009/01/marijuana_field_found.html


Strategic Security Blog
A project of the Federation of American Scientists
« More from NNSA: and more is less, or less is more. | Main | United States Removes Nuclear Weapons From German Base, Documents Indicate »
New Chinese Ballistic Missile Submarine Spotted
By Hans M. Kristensen
Google
A new satellite image appears to have captured China's new ballistic missile submarine. Coordinates: 38°49'4.40"N, 121°29'39.82"E
A commercial satellite image appears to have captured China's new nuclear ballistic missile submarine. The new class, known as the Jin-class or Type 094, is expected to replace the unsuccessful Xia-class (Type 092) of a single boat built in the early 1980s.
The new submarine was photographed by the commercial Quickbird satellite in late 2006 and the image is freely available on the Google Earth web site.
BLOGS & WIKIs with Google Earth provide synergistic results
庆祝中国人民解放军建军 70 周年
XH
Other Links to check:
http://bbs.keyhole.com/
http://www.gearthblog.com/
http://www.ogleearth.com/
http://googleearthuser.blogspot.com/
http://viavirtualearth.com/
http://virtualearth.spaces.live.com/
http://earthissquare.com/
http://wikimapiablog.blogspot.com/
http://www.virtualglobes.org/blog/
http://googlesightseeing.com/
http://www.armscontrolwonk.com/
http://www.historypin.com/
http://www.digitalgeography.co.uk/
http://geimint.blogspot.com/


Geospatial "Crowdsourcing" North Korea
http://gizmodo.com/5277184/north-korea-secrets-uncovered-in-google-earth-by-amateur-spies


Moffett Federal Airfield, California
(Aerial image comparison showing what is possible using Google Earth and Wikimapia)
36% scale model of space shuttle tested in wind tunnel
Google

Micorsoft's Photosynth combines thousands of images for immersive onsite feel

(http://photosynth.net/default.aspx)

Some of the new applications, such as "Driving Simulator" combine several tools at once
(http://www.gaiagi.com/3d-driving-simulator/)

Stanford University Exemplar

CONCLUSIONS:

From CORONA to Commercial

- You No Longer Have To Be a Super Power!
- Virtual Globes Are a Great Starting Point for Any Assessments
- Ideal Global Visualization Tool
- Broad Area Search Tool
- Virtual Global Transparency:
  Free "Open Source" "Crowdsourcing" cadre
  (>1 Billion downloads!)
- Ground-Based Imagery Layers: Panoramio, Flickr, Street View, Photosynth
- And don't forget to try "Flight Simulator"

Finding the Earth's Most Recent Meteor Impact Crater with Google Earth

Note Ejecta Ray
Star Pattern

http://www.b14643.de/Sahara/Kamil_Meteor_Crater/index.htm

Google Earth Satellite Imagery Reveals Predator-Prey Behavior in Coral Reefs

"Studying satellite imagery of lagoons around remote and protected Heron Island in the Great Barrier Reef, researchers found they could easily identify a phenomenon known as "grazing halos." Scientists believe these areas are created by hungry herbivorous fish and sea urchins that pick a region clean of seaweed, revealing the substrate beneath. Seeking protection from predators in a reef, these herbivores venture out to feed only so far, creating a halo shape around their refuge. Therefore, these areas are the result of a complex game of cat and mouse between marine predators and their cautious prey."

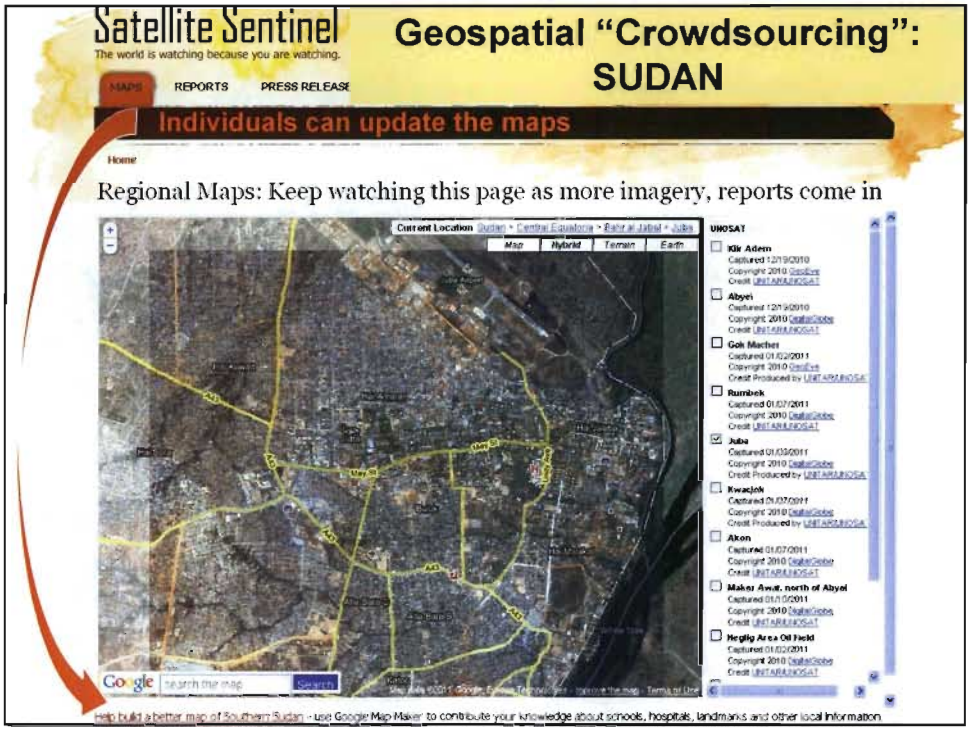
Commercial Satellite Imagery Reveals Existence of New Uncontacted Amazon Tribe

"The Brazilian government confirmed the existence of a community of uncontacted Amerindians in a protected area near the Peruvian border, reports Funai, Brazil's Indian affairs agency."

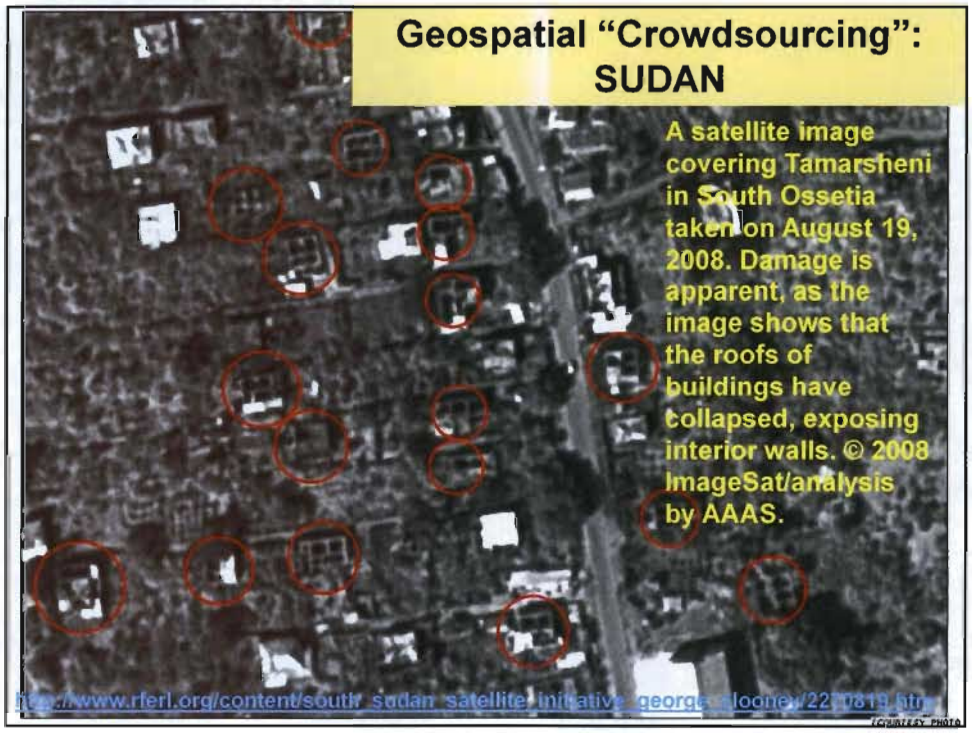
"Funai said the tribe came to the attention of authorities after satellite images revealed three large clearings in the Vale do Javari reservation, which is nearly the size of Portugal and is known to house at least 14 uncontacted tribes. Subsequent airplane fly-overs in April provided more data. "

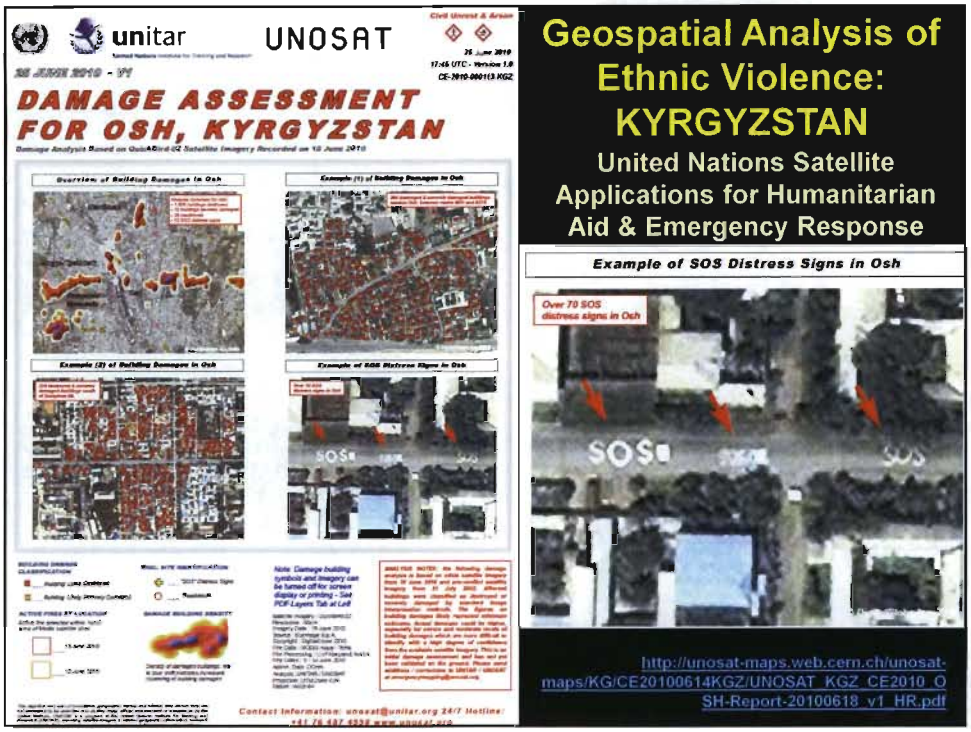
Sources: http://www.survivalinternational.org/about/funai and http://news.mongabay.com/2011/0622-amazon_tribe_pano_javari.html

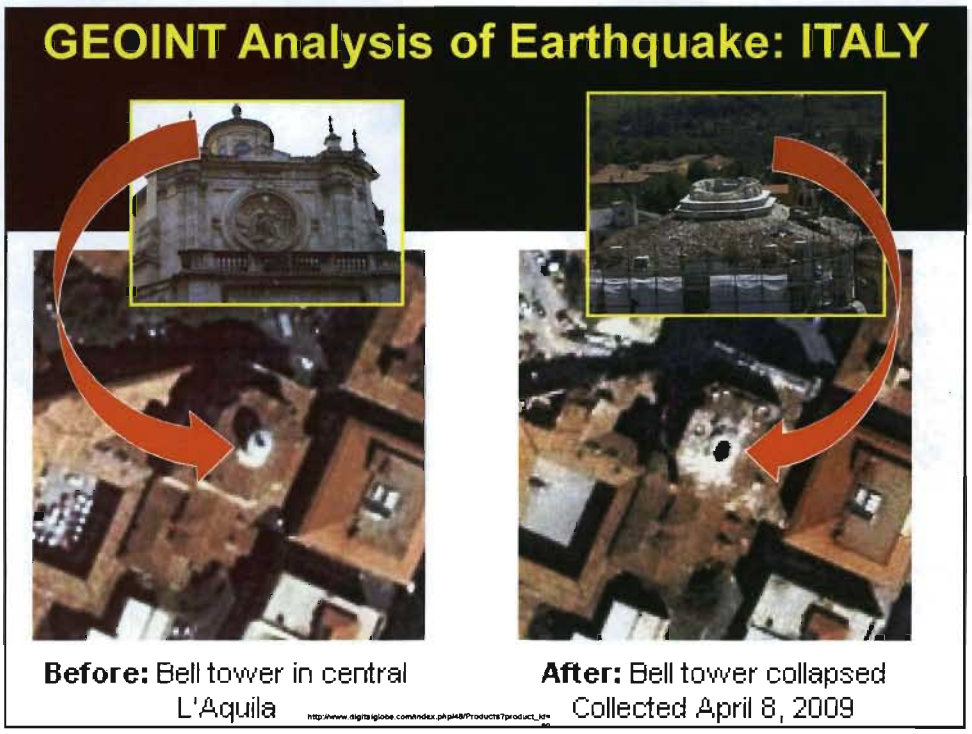

Satellite Sentinel
The world is watching because you are watching.
MAPS
REPORTS
PRESS RELEASE
Geospatial "Crowdsourcing": SUDAN
Sudan Peace Watch: Enough Project
Watch Our Video: Endgame in Sudan http://www.satsentinel.org/
George Clooney: Endgame in Sudan
Help Stop a War Before It Starts
Take action now. Sign the petition to President Obama. Get updates from @SudanSentinel and spread the word on Twitter. Learn how Google Map Maker can help southern Sudan.
Deterring a Possible War and Genocide in Sudan
A message from George Clooney and John Prendergast.

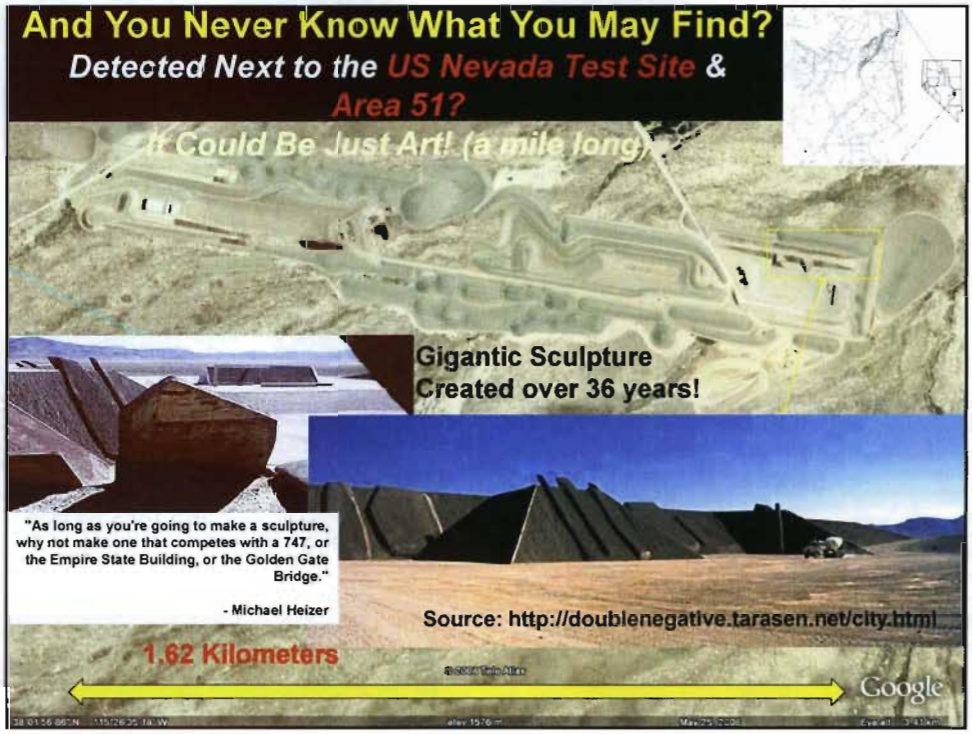

Satellite Sentinel
The world is watching because you are watching.
MAPS
REPORTS
PRESS RELEASE
Geospatial "Crowdsourcing": SUDAN
Individuals can update the maps
Home
Regional Maps: Keep watching this page as more imagery, reports come in
Current Location
Map
Hybrid
Terrain
Earth
UNOSAT
Google
Help build a better map of Southern Sudan - use Google Map Maker to contribute your knowledge about schools, hospitals, landmarks and other local information

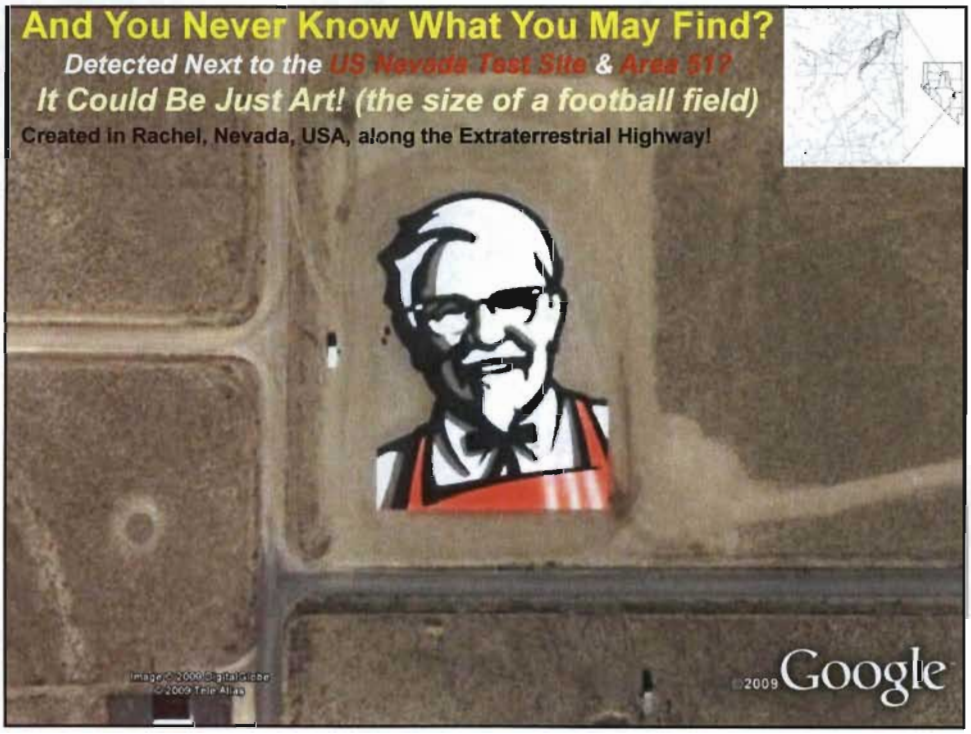

Outpost Near Muglad
South Kordofan, Sudan
Probable APC
Heavy Equipment Transports (HET)
Structures
Trucks
DigitalGlobe's Natural Color Satellite Image
January 12, 2011
Satellite Sentinel Project
Harvard Humanitarian Initiative
DIGITALGLOBE


Geospatial "Crowdsourcing": SUDAN
A satellite image covering Tamarsheni in South Ossetia taken on August 19, 2008. Damage is apparent, as the image shows that the roofs of buildings have collapsed, exposing interior walls. © 2008 ImageSat/analysis by AAAS.
http://www.rferl.org/content/south_sudan_satellite_initiative_george_clooney/2210819.html


unitar
UNOSAT
DAMAGE ASSESSMENT FOR OSH, KYRGYZSTAN
Geospatial Analysis of Ethnic Violence: KYRGYZSTAN
United Nations Satellite Applications for Humanitarian Aid & Emergency Response
Example of SOS Distress Signs in Osh
Over 70 SOS distress signs in Osh
http://unosat-maps.web.cern.ch/unosat-maps/KG/CE20100614KGZ/UNOSAT_KGZ_CE2010_OSH-Report-20100618_v1_HR.pdf


GEOINT Analysis of Earthquake: ITALY
Before: Bell tower in central L'Aquila
After: Bell tower collapsed Collected April 8, 2009


And You Never Know What You May Find?
Detected Next to the US Nevada Test Site &
Area 51?
It Could Be Just Art! (a mile long)
Gigantic Sculpture
Created over 36 years!
"As long as you're going to make a sculpture, why not make one that competes with a 747, or the Empire State Building, or the Golden Gate Bridge."
- Michael Heizer
Source: http://doublenegative.tarasen.net/city.html
1.62 Kilometers
Google


And You Never Know What You May Find?
Detected Next to the US Nevada Test Site & Area 51?
It Could Be Just Art! (the size of a football field)
Created in Rachel, Nevada, USA, along the Extraterrestrial Highway!
©2009 Google

Epilogue:"Fauxtography" is a potential problem! But far less so than ground imagery as there are multiple satellites from multiple vendors and nations

Original Image Un-"Photoshopped"

July 2008 Iranian missile launch was "Photoshopped"

http://thelede.blogs.nytimes.com/2008/07/10/in-an-iranian-image-a-

Why Stop at Just Four?

http://www.armscontrolwonk.com/1955/missile-palooza

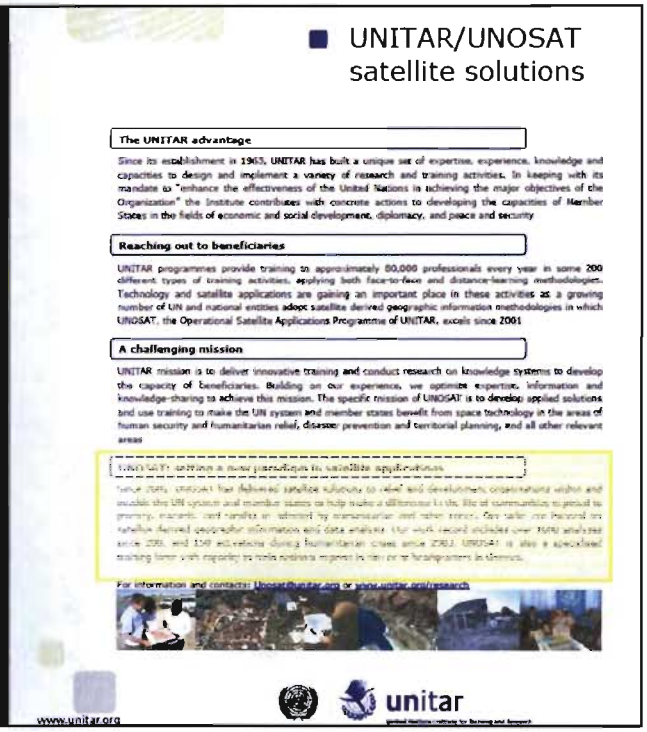
"Fauxtography"
Playing with Pixels
on
Overhead Imagery

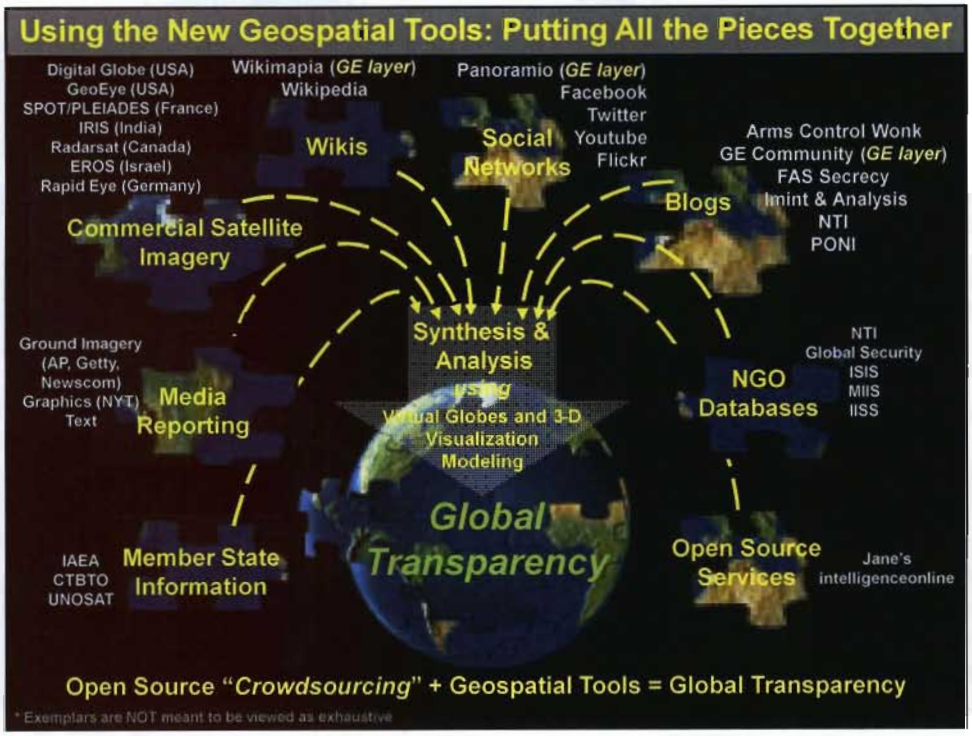
the ONION August 2, 2006

Visit To Google Earth Reveals House Is On Fire

Doctored Image

UNOSAT: An Alternative Career Path for Anyone Interested in Geospatail Intelligence




Using the New Geospatial Tools: Putting All the Pieces Together
Digital Globe (USA)
GeoEye (USA)
SPOT/PLEIADES (France)
IRIS (India)
Radarsat (Canada)
EROS (Israel)
Rapid Eye (Germany)
Commercial Satellite Imagery
Wikimapia (GE layer)
Wikipedia
Wikis
Panoramio (GE layer)
Facebook
Twitter
Youtube
Flickr
Social Networks
Arms Control Wonk
GE Community (GE layer)
FAS Secrecy
Imint & Analysis
NTI
PONI
Blogs
Ground Imagery
(AP, Getty, Newscom)
Graphics (NYT)
Text
Media Reporting
Synthesis & Analysis
using
Virtual Globes and 3-D Visualization Modeling
Global Transparency
NTI
Global Security
ISIS
MIIS
IISS
NGO Databases
IAEA
CTBTO
UNOSAT
Member State Information
Open Source Services
Jane's
intelligenceonline
Open Source "Crowdsourcing" + Geospatial Tools = Global Transparency
* Exemplars are NOT meant to be viewed as exhaustive


Questions?
http://blog.wired.com/defense/2008/07/attack-of-the-p.html